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ABSTRACT

Instructional systems development (ISD) is a systems approach to curriculum development and instructional delivery. It is oriented toward occupational needs with an emphasis on what it is that students must learn to perform specific tasks, what facilities best provide a setting for the neccessary learning, and what instructional methods and media best facilitate learning. There are four important differences between ISD and more traditional forms of instruction: (1) the requirement, through job analyses, occupational surveys, and feedback from graduates, of the thoughtful selection of what is to be taught based on data from the field: (2) attention given to how training is to be conducted, especially consideration of innovative alternatives: (3) use of test data based on absolute standards of performance to grade students and judge quality of instruction: and (4) application of contemporary technology to optimize instructional effectiveness, efficiency, and cost. Following the narrative discussion, the report describes the five phases of ISD--analysis, design, development, implementation, and control/evaluation--through text and accompanying charts showing the sequence of events. Event outcomes are also listed. A six-page glossary is appended. (YLB)

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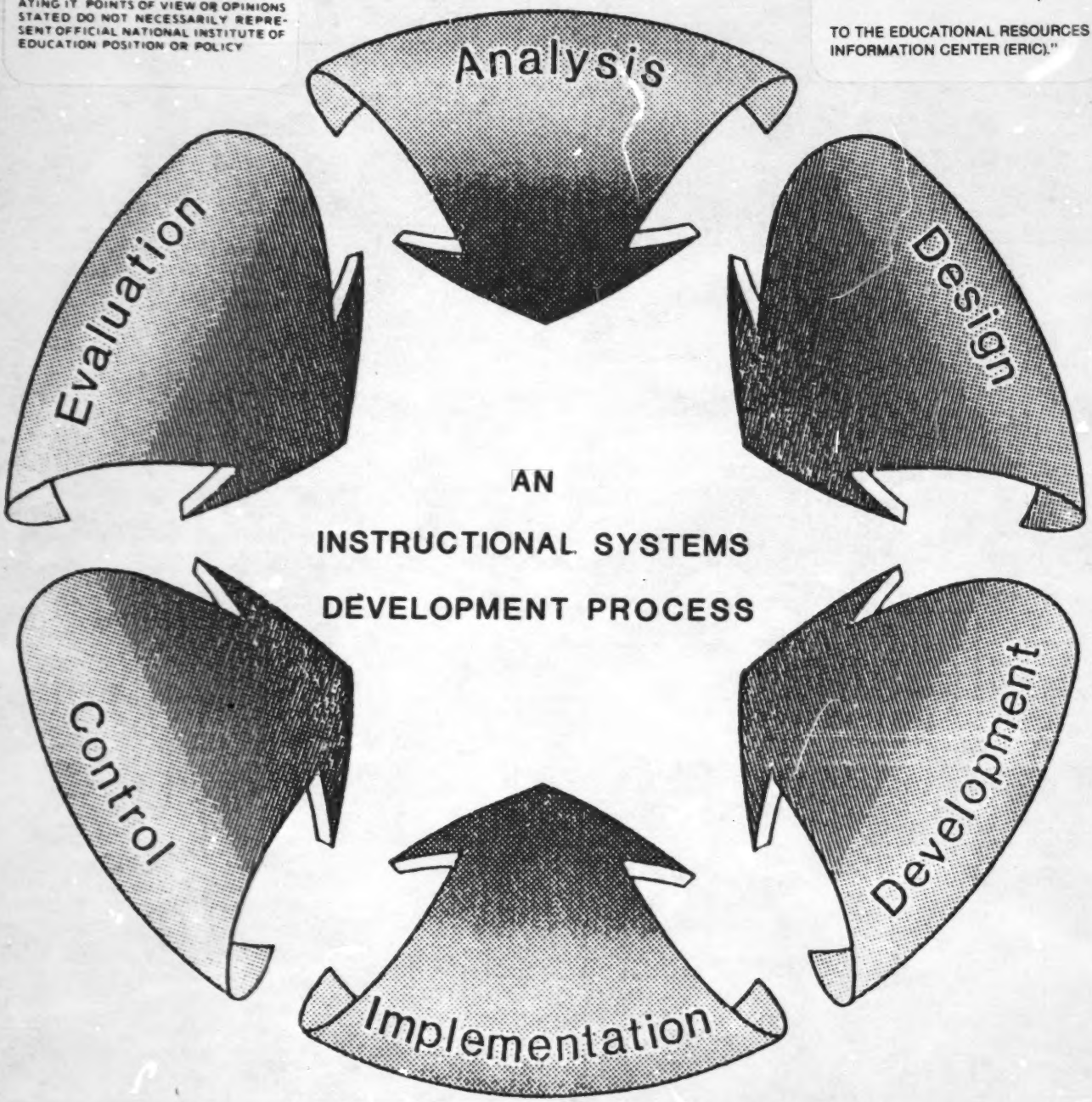

AN INSTRUCTIONAL SYSTEMS DEVELOPMENT PROCESS

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Introduction

Instructional systems development (ISD) is a systematic procedure for course planning, development, implementation and control. This system provides an integrated combination of personnel (students, instructors, curriculum developers, media specialists, etc.), materials, equipment, facilities, procedures and techniques performing efficiently the functions required to achieve learning objectives. The ISD approach is oriented toward occupational needs with an emphasis on what it is that students must learn to perform specific tasks, what facilities best provide a setting for the necessary learning, and what instructional methods and media best facilitate learning.

ISD procedures have grown out of basic research in management, communication and behavioral sciences. Research areas in the management sciences which are important to ISD include: job and task analysis, occupational survey techniques and computer technology. From the communication sciences, research in communications and media utilization have produced a wide variety of alternative techniques and procedures for accomplishing learning objectives. There are three areas of research in the behavioral sciences which have yielded results that are useful in ISD: 1) learning research has provided a foundation for the design of alternative approaches to instruction, 2) measurement and evaluation of behavior has matured to a level of scientific precision which provides greater confidence in available practices and procedures, and 3) the recent past has seen a large variety of instructional design and management approaches which have yielded noteworthy results.

An important difference between ISD and some traditional forms of instruction is that the ISD approach, through job analyses, occupational surveys and feedback from graduates, requires the thoughtful selection of what is to be taught based on data from the field. This practice tends to insure that instruction will be provided for those job tasks most critical to adequate employee performance, and not on those which have a low probability of meeting immediate job needs or critical intermediate to long-term needs.

A second important difference between other more traditional procedures and ISD is the attention given to how training is to be conducted. The recent past has seen a number of innovative approaches to instruction, many of which are either as good or better than traditional methodology. Consideration of such alternatives is required in ISD.

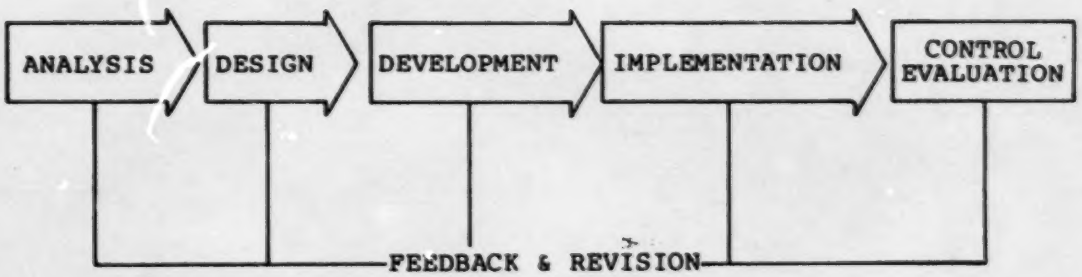
A third dissimilarity between traditional procedures and ISD is the ISD use of test data based on absolute standards of performance to grade students and to judge the quality of instruction. There are specific objectives that courses are planned to meet, and ISD requires that courses be evaluated on their ability to meet those stated objectives, and be revised if they fail to do so.

Finally, the ISD procedure requires the application of contemporary technology in order to optimize instructional effectiveness, efficiency and cost. Applying the systems approach to Vocational and Technical Education or Training can result in more individualized, more student centered, more humanistic teaching/learning than the traditional way of doing things.

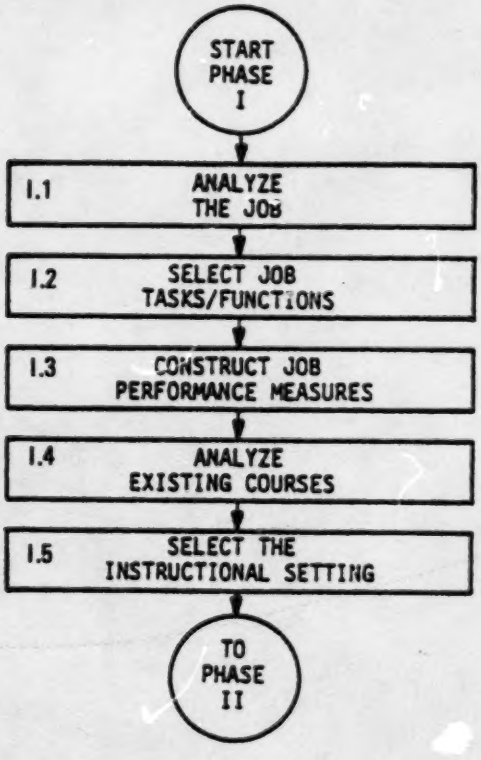
The Phases of Instructional Systems Development

Instructional Systems Development is a "systems approach" to curriculum development and instructional delivery. It consists of five (5) major phases: I) Analysis, II) Design, III) Development, IV) Implementation and V) Control/Evaluation. The ISD model illustrated below shows symbolically the five phases as well as the feedback and revision connect. Each phase is described by the following text and accompanying charts.

INSTRUCTIONAL SYSTEMS DEVELOPMENT



Phase I, Analyze. Phase I of course development requires a thorough analysis of the training needs and bases all inputs, processes and outputs on job related information. In this phase, an inventory of job tasks is compiled and divided into two groups: 1) tasks selected for instruction and 2) tasks not selected for instruction. Job performance measures are developed for tasks selected for instruction. They are determined through job analysis and verified by subject matter experts. Existing course documentation and other available material is examined to determine if all or portions of the analysis phase and other phases have already been done by someone else. As a final step in the analysis phase, the tasks selected for instruction are analyzed for the most suitable instructional setting (e.g., classroom and/or shop instruction, on-the-job training, etc.) for each task. The illustration below shows the sequence of events required in the analysis phase of course development.


START PHASE I
1.1 ANALYZE THE JOB
1.2 SELECT JOB TASKS/FUNCTIONS
1.3 CONSTRUCT JOB PERFORMANCE MEASURES
1.4 ANALYZE EXISTING COURSES
1.5 SELECT THE INSTRUCTIONAL SETTING
TO PHASE II

EVENT OUTCOMES:

.1 a list of tasks performed in a particular job

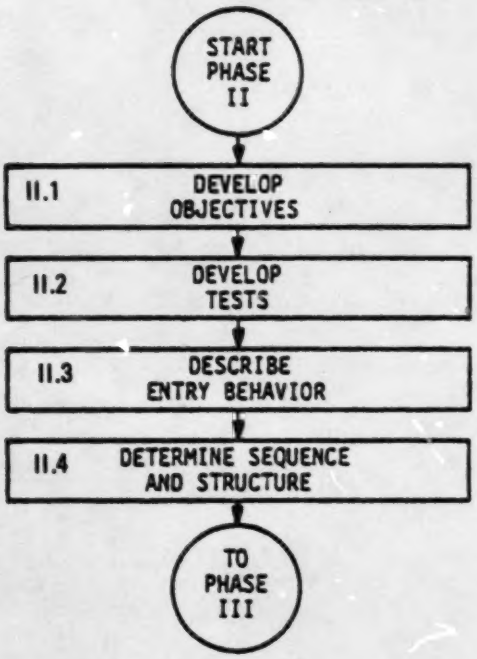
.2 a list of tasks selected for instruction

.3 a job performance measure for each task selected for instruction

.4 an examination of the job analysis, task selection and performance measure construction for any existing instruction to determine if these courses are usable in whole or in part

.5 selection of the instructional setting for tasks selected for instruction

Phase II, Design. Beginning with Phase II the model is concerned with designing instruction using the job analysis information from Phase I. The first step is the conversion of each task selected for instruction into a terminal objective. Each terminal objective is then analyzed to determine enabling objectives and learning steps necessary for mastery of the terminal objective. Criterion referenced measures (tests) are designed to match the objectives. A representative sample of students is tested to insure that their entry behaviors i.e., general ability and prior experience, match the level of learning analysis. Finally, a sequence of instruction is designed for the objectives. The chart below illustrates the sequence of events necessary in the design phase.



EVENT OUTCOMES:

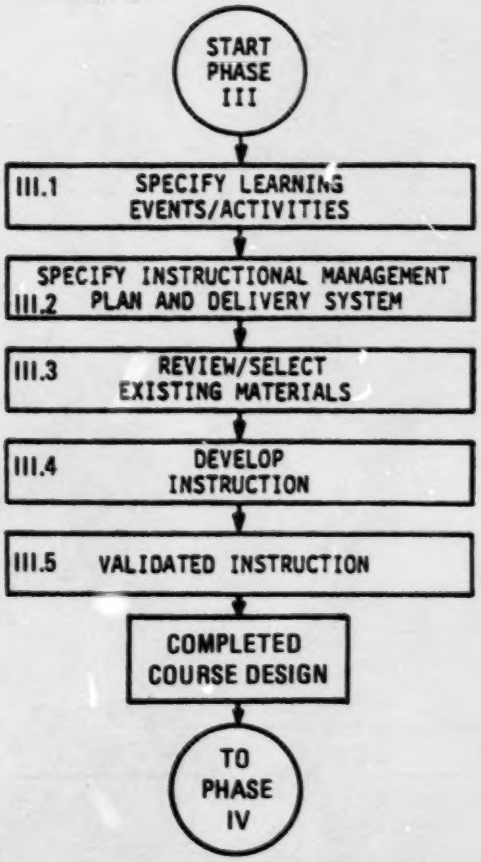
.1 terminal and enabling objectives and a learning analysis of each task selected for instruction

.2 criterion referenced test items to measure each objective

.3 a test of entry behaviors to see if the original assumptions were correct

.4 the sequencing of all dependent tasks

Phase III, Develop. The instructional development phase begins with the classification of objectives by learning category so as to identify guidelines necessary for optimum learning to take place. Determining how instruction is to be packaged and presented to the student is accomplished through a media selection process which takes into account such factors as learning category and guideline, media characteristics, training setting criteria and costs. Instructional management plans are developed to allocate and manage all resources for conducting instruction. Instructional materials are selected or developed and tried out. When materials have been validated on the basis of empirical data obtained from groups of typical students, the course is ready for implementation. The chart which follows illustrates the sequencing of events to be followed in the development phase.



EVENT OUTCOMES:

.1 the classification of objectives by learning category and the identification of appropriate learning guidelines

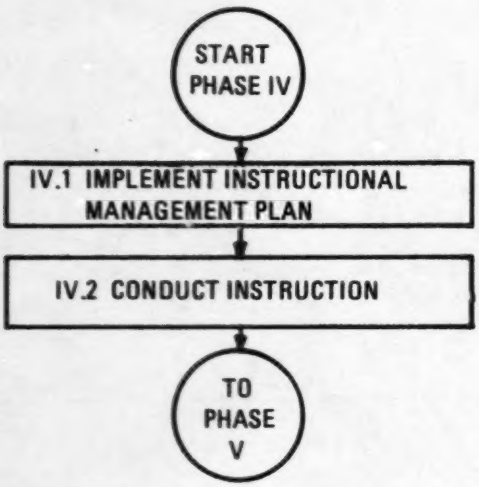
.2 the media selections for instructional development and the instructional management plan for conducting the instruction

.3 the analysis of packages of any existing instruction that meets the given objective(s)

.4 the development of instruction for all objectives where existing materials are not available

.5 field tested and revised instructional materials

Phase IV, Implement. Staff training is needed for the implementation of the instructional management plan and the instruction. Key personnel should be trained to be managers in the specified management plan. The instructional staff must be trained to conduct the instruction and collect evaluative data on all of the instructional components. At the completion of each course cycle, management staff should be able to use the collected information to improve instruction for the succeeding cycle. The illustration below shows the sequence of events for the implementation phase.

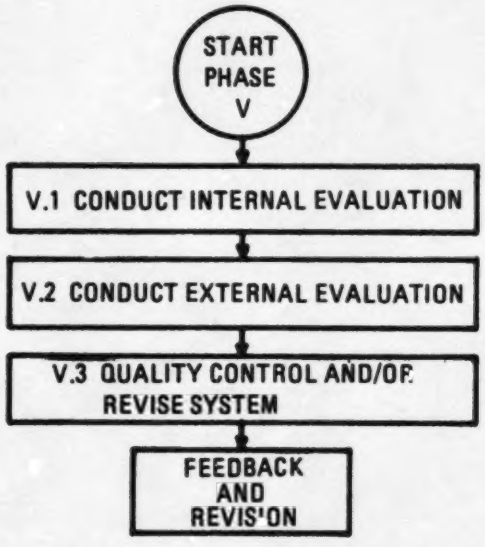


EVENT OUTCOMES:

.1 documents containing information on time, space, student and instructional resources and staff trained to conduct the instruction

.2 a completed cycle of instruction with information needed to improve it for the succeeding cycle

Phase V, Control. Phase V provides for the evaluation and revision of instruction. This should be done by personnel who are preferably neither the instructional designers nor the managers of the course under study. The first activity (internal evaluation) is the analysis of learner performance in the course to determine instances of deficient or irrelevant instruction or possibly overtraining. The evaluation team then suggests solutions for the problem(s). In the external evaluation, job task performance on the job is assessed to determine the actual performance of course graduates and other job incumbents. All collected data, internal and external, can be used for maintaining instructional quality control standards and as input to any phase of the system for revision. The chart below shows the sequence of events for the quality control and evaluation phase.


START PHASE V
V.1 CONDUCT INTERNAL EVALUATION
V.2 CONDUCT EXTERNAL EVALUATION
V.3 QUALITY CONTROL AND/OR REVISE SYSTEM
FEEDBACK AND REVIS'ON

EVENT OUTCOMES:

.1 data on instructional effectiveness

.2 data on job performance in the field

.3 instructional system revised on basis of empirical data

GLOSSARY

It is the aim of this alphabetical glossary to provide a source for arriving at some common understanding of terminology which will facilitate more exacting communication.

ABSOLUTE STANDARDS: A statement defining the exact level of performance required of a student as a demonstration that he has mastered the course objective(s). Criterion-referenced tests are usually based on an absolute standard.

ACHIEVEMENT GROUPING: Arrangement whereby students are assigned to groups according to their performance on pretests of units of the course.

ACTION VERBS: Verbs that convey action and reflect the type of learning that is to occur. Action verbs must reflect behaviors that are measurable, observable, verifiable and reliable.

ASSESSMENT: A judgment of the effectiveness and efficiency of a training system, in terms of measurement and evaluation.

ATTITUDE: A persisting state of a person that influences his choice of action.

AUDIOVISUAL AID: Any static or dynamic demonstrative training aid utilized to facilitate and reinforce learning through one or both of the physical senses of sight and hearing.

AUDIOVISUAL EQUIPMENT: Equipment used for the recording, production, processing and exhibition of audiovisual products.

AUDIOVISUAL MEDIA: Refers to any media such as videotape or film which is both seen and heard.

BASELINE DATA: Valid and reliable information about the current level of performance of the intended student population. This data can be used to confirm the need to develop new instruction, or can be used as a comparison in ascertaining differences between students' performance before and after instruction.

BEHAVIOR: A student's visable action, performance, operation or product which can be classified or labeled by an observer according to specific and discrete criteria.

CONDITIONS: Occurs in terminal objectives; describes what is presented to the student in order to accomplish the specified action, that is, it describes the important aspects of the performance environment.

COURSE DOCUMENTATION: Information describing the current content of a course (instructional materials, tests, instructor's manual, evaluation plan, student's manual) and its developmental history (job analysis, criteria for selecting tasks for training, previous revisions).

COURSE OBJECTIVE: A description of the ultimate purpose of the course, including a statement of who is to be trained, what he is to be trained to do, the degree of qualification brought about by the training, and where and under what general conditions the graduate will perform on the job.

CRITERION-REFERENCED TEST: Measures what an individual can do or knows, compared to what he must be able to do or must know in order to successfully perform a task. Here an individual's performance is compared to external criteria or performance standards which are derived from an analysis of what is required to do a particular task.

CRITICAL SEQUENCE: Sequencing of topics or objectives according to their importance.

DATA: Collection of facts or numerical values resulting from observations of situations, objects, or people.

ENABLING OBJECTIVE: A three-part objective that helps the student achieve a terminal objective. It describes the behavioral actions, the performance conditions, and the attainment standard expected of the student when he completes the task.

ENTRY BEHAVIOR: The skill, knowledge and/or attitude required before beginning a new segment of instruction; also may refer to the capability a person has prior to new learning.

ENTRY SKILLS: Specific, measurable behaviors that have been determined through the process of analysis of learning requirements to be basic to subsequent knowledge or skill in the course.

ENTRY SKILLS TEST: A measurement instrument designed to determine if a student already possesses certain skills or knowledge needed as a prerequisite before undertaking new instuction.

ENTRY TEST: Contains items based on the objectives that the intended students must have mastered in order to begin the course.

EVALUATION: The process of interpreting the results of measurement data (e.g., tests, JPMs) for the purpose of making a judgment or decision on the instruction or on the success of a trainee.

EVALUATION PLAN: A method or outline of what set of procedures will be used to gather data and information for the purpose of assessing a course of instruction.

FEEDBACK: The return of information. Information on student performance is "fed" back to the student so that he can improve that performance; to the instructional designer so that he can improve materials and procedures on the basis of student needs; to the management system so it can monitor the internal and external integrity of the instruction and make appropriate revisions. Or, refers to the

flow of data or information from one step in the ISD Model to others.

FOLLOW-UP ACTIVITIES: The work events that occur after a course of instruction has been completed.

FORMATIVE EVALUATION: The iterative process of developing and improving instructional materials and procedures.

FRONT END ANALYSIS: Refers to job analysis, selection of tasks for training, and development of JPMs.

GO NO-GO: Pass-fail; criterion of evaluation whereby student cannot be "partially correct". He is either 100% correct (go) or incorrect (no-go).

INDEPENDENT RELATIONSHIP: Occurs when skills and knowledges in one objective are unrelated to those in the other objective. Mastering one of the objectives does not simplify the other.

INDIVIDUALIZED INSTRUCTION: Refers, in the ISD Model, to a management scheme which permits individual characteristics of trainees to be a major determinant of the kind and amount of instruction given. Here, it nearly always implies some form of self-pacing.

INSTRUCTIONAL STRATEGIES: Methods of presentation, practice and evaluation specifying the ways in which the desired learning outcomes are to be achieved in the instructional setting (e.g., tutorial, lecture/discussion, demonstration, etc.).

INSTRUCTIONAL UNIT: An assembly of lessons which have been integrated, either to complete a usable bit of knowledge or skill, or to aid in scheduling a course or program. The basic components of courses. Same as "Unit of Instruction."

INTERNAL EVALUATION: Assessment of the effectiveness of an instructional program in terms of student performance on stated terminal objectives.

JOB: The duties and tasks performed by a single worker constitute his job. If identical duties and tasks are performed by several individuals, they all hold the same job. The job is the basic unit used in carrying out the personnel actions of selection, training, classification and assignment.

JOB ANALYSIS: The basic method used to obtain a detailed listing of duties, tasks, and elements necessary to perform a clearly defined, specific job, involving observations of workers and conversations with those who know the job, in order to describe in detail the work involved, including conditions and standards.

JOB PERFORMANCE MEASURES: Tests that are used to evaluate proficiency of a job holder on each task he performs.

JOB SHEET: An instruction sheet which provides for the individual student a list of the principal steps to be taken in doing a job in the order in which they are to be done. Job sheets also provide the student with the objective(s) to be accomplished and list the references, equipment, and materials required.

KNOWLEDGE: Specific information or facts required to develop the skills and desired attitudes to effectively accomplish prescribed jobs, duties and tasks.

LEARNER CHARACTERISTICS: The traits possessed by learners that could affect their ability to learn (e.g., age, I.Q., reading level, etc.).

LEARNING ANALYSIS: A procedure to identify subelements that must be learned before a person can achieve mastery of the performance.

LEARNING CATEGORY: A division of learning behavior. All learning may be classified into one of four learning categories: mental skill, physical skill, information, or attitude.

LEARNING HIERARCHY: Graphically portrays the relationships among learning tasks in which some tasks must be mastered before others can be learned.

LEARNING STEP: Occurs when enabling objectives are broken down into smaller parts.

LESSON GUIDE: An organized outline of a single lesson topic taken from the course of study and serving as a blueprint of what is to be accomplished in class. It is complete in detail and states all objectives, topics, subtopics, references, training aids, methods, procedures, and other supplemental information as needed. In general, the lesson guide is the formal lesson plan.

MANAGEMENT PLAN: Program for the assignment, monitoring, and assessment of the personnel, materials and resources dedicated to a specific mission, operation, or function.

MASTERY: In terms of learning, refers to meeting all of the specified minimum requirements for a specific performance. Criteria for mastery are defined in the design phase of the ISD Model.

METHODS: The means, techniques, procedures, etc., of instruction. There are many methods appropriate for use. Included may be such processes as lecture, recitation, practical application, examination, study periods, demonstrations, use of training aids, group discussions, reviews, demonstration-performance, panel discussions, role playing, case studies, craftsman, programed instruction, and coach and pupil methods.

MEDIA: Means for presenting instructional material to learners; for example, books, audiotapes, and filmstrips.

MEDIA SELECTION: Is the major means of determining how instruction is to be packaged and presented to the student.

MODULE: An individualized self-instructional package usually containing all the necessary materials a learner needs to meet some or part of a terminal objective.

MULTIMEDIA PACKAGE: Self-contained instructional unit in more than one medium.

ON-THE-JOB-TRAINING (OJT): A program of training designed specifically to train an individual, without the necessity for interrupting his performance of daily assigned duties relative to his work assignment. OJT programs may range in complexity from those designed to train an entry level student to become fully qualified in the case of simple tasks, to programs designed to take an individual who possesses the fundamental principles required to understand the tasks from this level to that of an individual who is fully qualified to perform all the tasks and duties of his position without assistance.

OVERLEARNING: Refers to the continual practice on a learning task by a person who has correctly performed the task.

PEER TUTORING: A form of instruction in which students at the same or more advanced level of knowledge provide instruction to students at the same or lower level of knowledge on the specific objectives under consideration.

PERFORMANCE MEASURES: The absolute standard by which a job performance is judged. A performance measure is the inventory of job tasks with each performance objective.

PERFORMANCE TEST: A sample work situation in which personnel being tested perform a practical task which requires them to demonstrate how well they have mastered the skills required for the performance of their job. For some circumstances this could be a written test if designed as a job sample for personnel whose responsibilities involve only paper procedures.

POST-TEST: A test administered after the completion of instruction to assess whether a student has mastered the objectives of the course or unit.

PRE-TEST: Administered prior to instruction to determine how much the student already knows.

PROGRESS TESTS: Short examinations administered daily or weekly throughout the course to evaluate student progress.

QUALITY CONTROL: Process of measuring and evaluating in order to maintain course standards through adjustments in instructional materials or procedures.

RELIABILITY: The consistency with which a test measures the amount of student achievement.

SAMPLE: A portion or small segment of the students for whom instruction is designed.

SELF PACING: Mode of instruction whereby each studnt works through the instructional materials at his own rate of speed.

SEQUENCING: Ordering instruction; proper sequencing allows the learner to make the transition from one skill or body of knowledge to another, and assures that supporting skills and knowledge are acquired before dependent performances are introduced.

SKILL: The ability to perform a job-related activity which contributes to the effective performance of a task.

STANDARDS: Occurs in terminal and enabling objectives; describes the criterion or standard of performance which must be attained.

SUBJECT MATTER EXPERT: A person who has professional skill in the performance of some job and who is consulted by an instructional designer in the process of job task analysis.

SYSTEMS APPROACH: A generic term referring to the orderly process of analysis, design, development, evaluation, revision, and operation of a collection of interrelated elements.

TARGET POPULATION: The pool of potential entrants to training for which instructional materials are designed and tried out.

TERMINAL OBJECTIVE: A three-part objective expressed in terms of and keyed to tasks as listed in the Training Analysis Summary that helps the student achieve the course objective. It describes the behavioral actions, the performance conditions, and the attainment standard expected of the student when he completes the task.

TRADE-OFFS: In any systematic approach to instruction, it is necessry to make compromises between what is desirable and what is possible. Ordinarily, these decisions involve increases or decreases in time, money, facilities, equipment, or personnel. Training aids and simulators represent examples of trade-offs.

TRAINING ANALYSIS: A process for proceeding from an inventory of tasks, such as that provided by a job task analysis, to an organized set of course, terminal, and enabling objectives.

TRYOUT: Practice test; the purpose is to make the tryout as realistic as possible by eliminating as many sources of unreliability as possible.

UNDERTRAIN: Provide inadequate training that does not prepare a student to meet regular job performance requirements.

VALIDATION: A process through which a course is revised until it is effective in realizing its instructional goal.

VALIDATION PROCESS: Testing instructional materials on a sample of the target population to insure that the materials are effective.

VALIDITY: The degree to which a test measures what it claims to measure.

WRITTEN TEST: A test in which an individual demonstrates his capabilities by written techniques. Not usually a performance test, and hence is usually a measure of supporting knowledges rather than skills.

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